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The Forester,

An Illustrated Monthly Journal of Forestry

Devoted to the Conservation of Forests, the Proper Utilization of Forest Products, the Forestation of Waste-Lands and the Preservation of Game.

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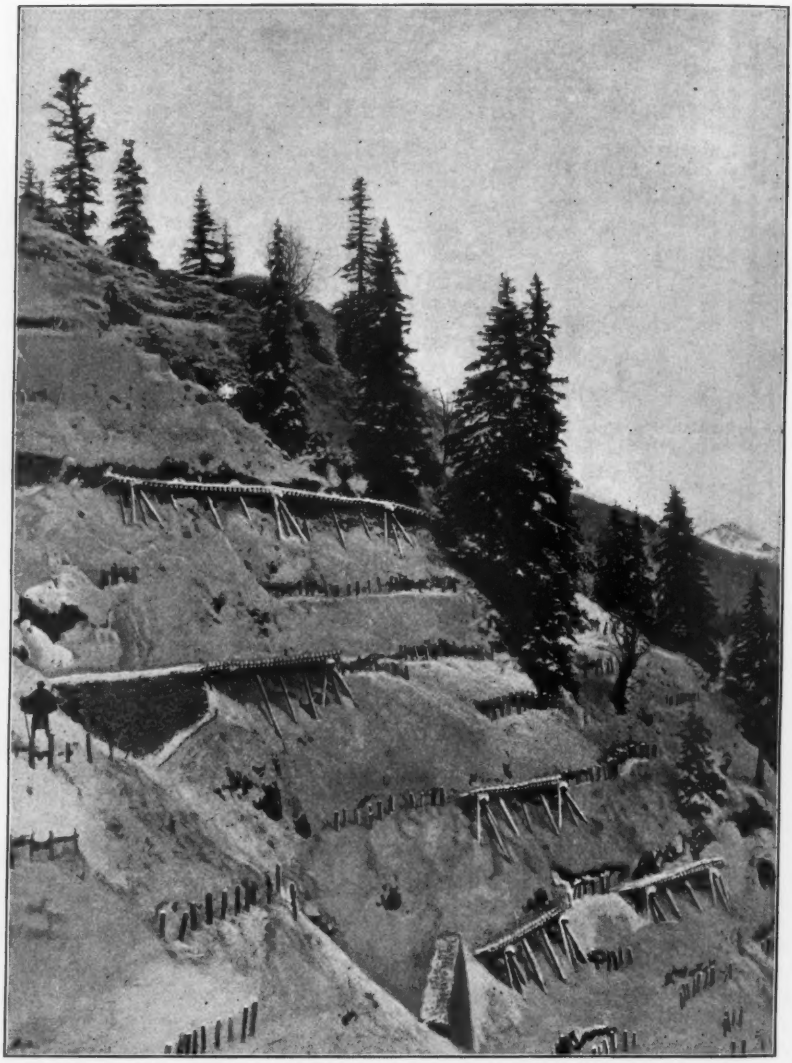

CONSTRUCTIONS FOR THE PREVENTION OF AVALANCHES IN THE SWISS HIGH ALPS.

[PLATE LOANED BY DR. FANKHAUSER, OF BERN, SWITZERLAND.]

THE FORESTER.

VOLUME III. SEPTEMBER 1, 1897. NO. 9.

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An Illustrated Monthly Journal of Forestry.

THE FORESTER contains articles pertaining to all branches of Forestry: The Prevention and Extinguishment of Forest Fires, Improved Methods of Cutting, Useful and Injurious Insects and Fungi, Useful Birds, the Establishment of City Forests, State and Federal Reservations, Water Supply, Forest Legislation, Forest Influences, Forest Utilization, Forest Products, Road Construction, Reclamation of Waste Lands, etc., etc.

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CONTENTS.

Owing to the condition of affairs in reference to the federal forest reserves, it will no doubt be many years before they can be put under anything like a system of forest management. The first and most important step is to protect them from further devastation. This can be most quickly and easily done by the army. Forest protection, to be of any use whatever, must be permanent, and in the army there is more stability than exists, or is likely to exist, in any other government institution. With a good, stiff forestry course at West Point, officers capable of doing such service can be graduated. Furthermore, a soldier could have no fitter duty than protecting the forests owned by the government from vandals and reckless herdsmen and hunters.

"For it must be told again and again," says John Muir, in the *Atlantic Monthly*, 'and be burningly borne in mind, that just now, while protective measures are being deliberated languidly, destruction and use are speeding on faster and further every day. The axe and the saw are insanely busy, chips are flying thick as snowflakes, and every summer thousands of acres of priceless forests, with their underbrush, soil, springs, climate, scenery, and religion, are vanishing away in clouds of smoke, while, except in the national parks, not one forest guard is employed."

We would like to call attention once more to an important volume which has recently appeared and which is indispensible to the library of an American botanist or forester. We refer to Sudworth's Arborescent Flora of the United States, issued by the Forestry Division of the United States Department of Agriculture. It is a monument of patient toil and accurate technical knowledge, and although dry and incomprehensible to the majority of people, is the most useful of recent forestry publications.

Mr. W. A. Stiles, of *Garden and Forest*, is seriously ill.

Avalanches and their Prevention in the Swiss Alps.

BY DR. F. FANKHAUSER.
(Adjunkt des Schweiz. Ober forstinspektorates.).

Every country has its special calamaties. Climate and constitution of soil determine the peculiar natural phenomena which endanger plant and animal life and threaten the existence of man, forcing him to devise suitable protective measures for saving himself and his possessions from the destructive power of the elements.

Sea coasts are a prey to the shifting sand dunes, and low-lying meadows are visited by recurring floods. In no less degree are many high mountain regions imperilled by the avalanche. This is especially true of the Swiss high Alps, whose relatively moist climate, joined with frequent very warm currents of air, particularly favor the formation of snow-slides.

The different varieties of avalanches are to be distinguished according to their origin. Those best known are the so-called "ground slides" (*avalanches de fond*), which are for the most part detached in spring when warm weather opens, and especially during the mild south winds. When, in consequence of these causes, a mass of snow covering the earth to a depth of perhaps several metres, begins to melt, the water trickles through to the soil, and if the slope is sufficiently great, it flows off between the ground and the bed of snow, thus loosening the hold of the latter, which, from its weight of melted water, begins to move, unless held fast by the uneven surface of the ground.

If, on the other hand, there is a snowfall in winter time, during cold weather, the snow is then fine and dry as sand; it is, then, not susceptible of becoming packed and of adhering to the ground, but rests on it as the lightest of coverings. On a steep, bare mountain side the least occasion, therefore, such as a puff of wind, a falling stone or the chamois' tread will suffice to set in motion this snow mass, then called a "dust avalanche" (*avalanche de poussiere*). This dust avalanche, not improperly to be compared to a snow cloud descending upon the valley with tremendous speed, causes the air to be compressed and driven with ever-increasing velocity as a hurricane before the avalanche. The enormous force of this air current is perceptible at great distances. It blows over the herdsmens' wooden huts and stalls like card houses, and often lays low whole forests on the opposite side of the valley.

A third sort of avalanche are the so-called glacier avalanches, which can be seen and heard every warm summer day among the high Alps, on the precipitous slopes covered with eternal snows, as, for instance, on the northern slope of the Jungfrau, as seen from the Wengern Alp. These avalanches arise, when, through melting, the slowly-moving glacier mass is pushed over the edge of an over-hanging precipice and breaks off, plunging into the valley in ice particles resembling in form and effect the dust avalanches. Frequent as these glacier avalanches are, they seldom reach the cultivated lands below; fortunately so, for here preventive constructions are precluded.*

Even though the ground and dust avalanches do not possess such immense power, it is nevertheless enough to destroy in the valleys even the strongest works of protection; therefore only exceptionally are these resorted to: it is more customary to strike at the root of the evil and to prevent its cause. A forest affords the best protection against ground and dust avalanches. When steep mountain sides are clothed with wood growth even a deep snow covering cannot detach itself. Particularly in the plenter-wood, where trees of every age are mixed irregularly together, the snow is held fast and obliged to melt where it falls. The forest once removed, its restoration implies great difficulties and demands great sacrifice of time and expen-

* On September 11, 1895, a mass of snow and ice containing four and one-half million cubic metres, covering the peak of "Altels," broke loose and slid down a course three thousand two hundred metres long in the space of one minute, dashing upon the valley below with a force calculated at three hundred billion meter kilograms.

diture of labor and money. In the first place, in reforesting such regions, it becomes necessary to prevent, by artificial means, the snow mass from sliding down, until the forest has grown big and strong enough to perform again this office itself.

The usual means, and one employed everywhere if the depth of soil admits, is the plan of establishing bermen* and palisades. Horizontal terraces 50 to 60 centimetres wide are ranged above each other three to ten metres apart, according to the incline of the slope, and rows of stakes are driven in along the outer edge of the solid natural soil. These stakes are at least 150 centimetres long and 12 to 14 centimetres thick, and at distances of about 60 centimetres are driven for half their length into the ground and wedged fast with stones. If the soil is not deep enough for stakes to find a firm hold, then the so called snow bridges are constructed.

As is to be seen from the accompanying picture, these consist of logs or beams supported by solid wooden trestles, and running horizontally on the declivity, they serve as a support to the stakes which are driven in at a distance of 20 to 30 centimetres, not however in a vertical direction but about perpendicular to the incline of the mountain side. The long beams are on an average 25 to 30 centimetres thick while the stakes are about the same dimensions as those used in the palisades.

Together with these constructions in the localities where avalanches take their start, reforestation must go hand in hand, so that, in view of the extremely slow growth in Alpine regions, the stakes and snow bridges may not become rotten and worm-eaten before the young forest has grown up sufficiently.

The bermen or mountain terraces are especially suitable places for setting young plants, but they are also set in between the palisades, in fact at distances of 120 to 140 centimetres, so that on an average about 7000 plants per hectare are the result. Such close grouping is necessary, so that as soon as possible the trees may close up; they then give each other mutual protection, and as a consequence their growth is hastened.

As regards the species planted in such places it may only be remarked that usually the red fir (*Picea excelsa*), the larch (*Larix Europæa*), the mountain pine (*Pinus montana*), and the cembran pine (*Pinus cembra*) are alone considered.

Of deciduous trees, but few varieties reach into the higher altitudes. Such are the mountain ash (*Sorbus aucuparia*) and the mountain alder (*Alnus viridis*), but as these varieties do not form a solid stand (suitable for a barrier), they are of minor importance.

Alas even for the conifers, with their greater power of resistance, the vertical area of propagation remains a relatively limited one.

While the highest peaks of the Swiss Alps reach an altitude of over 4,600 metres above the sea level, and the lower limits of eternal snow vary from about 2,400 to 2,800 metres, the fir ceases to grow at 1,700 to 2,000 metres; the mountain pine and larch at 2,000 to 2,200 metres, and the cembran pine at 2,200 to 2,400 metres above the sea.

Above the timber line the building of avalanche barriers is mostly a hazardous and dubious undertaking. We do not allude to the scarcely accessible rocky precipices, but only to those steep, smooth declivities which often begin on the topmost ridges far above the timber line and give rise to avalanches which plunge far down to the inhabited and cultivated valleys below. In such regions the use of wood for constructing barriers is precluded, not only because it would have to be carried on the back long distances up hill, but because of its limited durability. When it is a question of works to be maintained forever, a solid stone material alone fulfills the requirements. Horizontal walls of dry masonry are built, which present not only a very durable obstacle, but at the same time one of great resistance to the snow masses. The height of the wall on the inner or mountain side should be at least one metre. The foundation is made so

* Bermen are narrow ledges or galleries cut in the living soil, beset with rows of short piling forming horizontal terraces.—Ed.

strong that with an inclination of one-fifth metre of the outer side of the wall there is still at the top a width of about 60 centimetres. The line of foundation should incline slightly downward from the outer to the inner edge. It is not necessary to dig down to a rocky bottom, yet the wall must never be placed on made ground, but only on natural soil. As is the case with the rows of wooden stakes, the walls, too, are built at different distances one above another according to the inclination of the slope: the most eligible places are where a slight flattening of the slope would naturally favor the gathering of a mass of snow behind the wall. If necessary the space is artificially extended. For the length of the walls no definite rule can be given: it depends upon local conditions. Rather are two short walls to be preferred to one long one, as the two short ones, broken by a short space between, accomplish the same object as a single wall as long as both, plus the interval.

In the long walls, or in those where gutters might be formed, it is desirable to construct one or more water outlets in the foundation, that is, where the substratum is earth, as otherwise, in the spring thaws, the melting water behind the walls penetrates into the soil and may occasion landslides.

The greatest danger in this sort of construction above the timber line consists in the formation of so-called upper avalanches. Supposing the steep slope to be covered with a snowfall so deep that the walls and the unevenness of surface occasioned by them entirely disappears, and then in succession warm and cold weather follow each other, there may be formed on the surface of the snow a strong, hard, icy crust. Should more fresh snow fall on this the chances are that it will start to slide on its slippery bed, and as soon as it has attained a certain velocity, together with greater pressure on the old snow cover underneath, this latter will be carried away down to the ground. Even the walls cannot withstand such a shock, and thus it may happen that these works are considerably damaged, at least in their lower sections.

As our picture shows, even within the timber limit the construction of masonry may be indicated, either because the wood growth, being scanty, should therefore be protected, or because, on the other hand, good building stone is available on the ground in question, or because it is wished to give special solidity to certain portions of the work. This is especially the case in gullies and depressions where the pressure of snow is particularly strong. Then, also, whenever the surface in question has a considerable extent in a vertical sense, avalanche barriers of palisade construction are gladly supplemented from time to time by the horizontal lines of stone walls, as these give greater solidity to the whole and besides, casually, have the great advantage of catching any loose stones caused by disintegrating rocks, which in falling would shatter a wooden construction from top to bottom, and in this way cause considerable damage.

Works which up to this time have been carried out in Switzerland according to the above described principles amounted at the beginning of last year to 136, covering an area of 981 hectare. The expenses, not including reforestation amounted to 785,200 francs.

In these works were used 62,230 cubic metres of masonry, 470,100 stakes, 4,636 running metres of snow bridges. These works are distributed pretty much among all the high mountain cantons of Switzerland. In Canton Tessin alone, from 1879 to 1896, 16 great constructions for the correction of avalanches have been built, at a cost of 124,100 francs, including forestation.

Wallis, Graubunden, Bern, Uri, Glarus, St. Gallen, Unterwalden, Schwyz, have all proceeded in the same way. It was mostly a question of protecting whole communities, single groups of houses, and farms or railroad lines (as for instance the St. Gotthard line), and roadways: more seldom for the preservation of the forest only. Especially in the works carried out below the absolute timber line success has been very grati-

fying, so that the people have gained full confidence in their efficacy, and are ready to bring further sacrifices in combatting the evil, for which the Federal government and the various cantons make considerable appropriations. This, indeed, it appears is not superfluous when it is understood that of the 1,600 avalanches which in Switzerland still threaten dwellings, traffic and forests, 600 are capable of being corrected, and still await conquest.

The Washington National Park.

A forest reserve in the State of Washington, known as the Washington National Park, was set aside by Congress about four years ago, and although it contains but 324 square miles, and is small in size compared with the Yellowstone and several other national reservations, still it is destined in a very short time to become even more famous than those boasting of a larger area. The principal feature of this reserve and the reason for the reservation is Mt. Tacoma, the highest and the grandest mountain in the United States. The park is located in the southeastern part of Pierce county, about forty miles from the city of Tacoma. It contains scenery rivaling that of the Yellowstone and the Yosemite, and the great mountain that lies very nearly in the centre stands unequalled and unrivaled in this country, and many travelers have declared that not even the Alps offer such a spectacle of natural grandeur and rugged beauty. It stands out in bold and regal splendor, towering nearly 15,000 feet above the level of the sea, and is clothed in an eternal mantle of snow.

"Tacoma is the monarch of mountains;
They crowned him long ago
On a throne of rocks, in a robe of clouds,
With a diadem of snow."

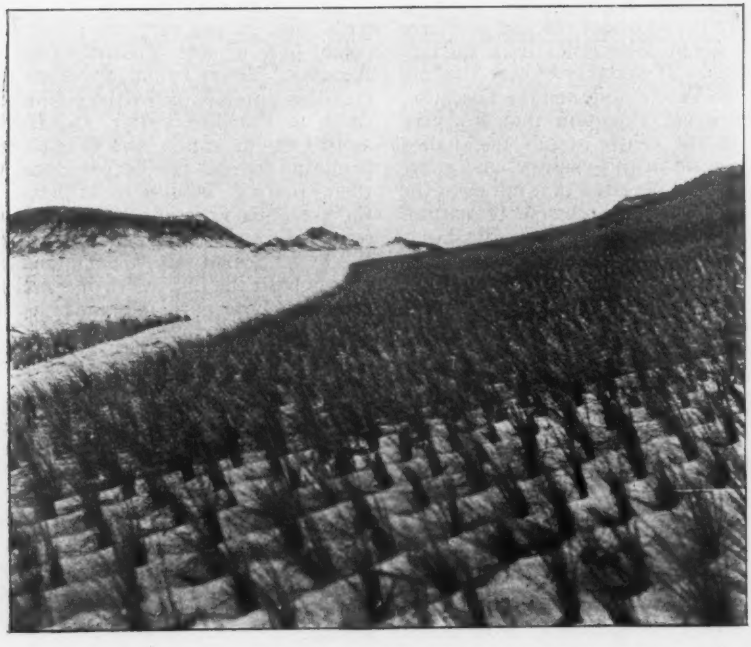
No equal area in the world has a greater diversity of natural phenomena and such magnificent scenery. Throughout the entire domain the park is a perfect wonderland of crystal streams and waterfalls, hot and mineral springs, lofty mountain peaks and deep canons, beautiful lakes and majestic forests. The glaciers and the perpetual snow which cover the summit and the great sloping sides of Mt. Tacoma form the source of a score or more of rivers and streams which flow through the park, some of them eastward and emptying their waters into the Columbia, some northward emptying into Puget Sound, and others westward and southward into the Columbia and thence to the Pacific Ocean. This immense system of irrigation, together with the frequent rains of the wet season, produce a dense vegetable growth in the forests consisting of immense trees —cedars, firs, hemlocks and spruce—and of undergrowth so very dense that it is almost impossible to force your way through it without hard work with an axe. Throughout the park are great monarchs of the forest over twenty feet in diameter, fit sentinels of the great mountain above them. Herds of deer, moose, elk and mountain goats wander through the forests and mountain fastnesses comparatively safe from incursions of hunters, although no wardens have as yet been appointed to guard the sacred precincts of the reserve.

The mountain and its surrounding park will, in the very near future, become one of the greatest resorts in America. Every summer tourists in increasing numbers cross the continent to camp in Paradise Valley, to view and ascend the mountain. and to explore the primeval forests, the deep canons, with their roaring mountain torrents, and the forest-embowered lakes filled with speckled trout. When the new railroad, the Puget Sound, Mt. Tacoma and Eastern, is built the fifty miles of travel from the city to the park will make a ride of unequaled scenic beauty.

MERIDEN S. HILL.

Tacoma, Washington.

Mr. Filibert Roth, timber expert in the employ of the United States Forestry Division, is inspecting the forests of Wisconsin. He is accompanied by Prof. Cheney, of the University of Wisconsin. The United States Forestry Division, the State Geological Survey and the State Forestry Commission are all working together to secure measures for forest protection.



THE DUNES OF CAPE COD, SHOWING PLANTINGS FOR FIXING THE SHIFTING SAND.
Plates loaned by the Massachusetts Harbor and Land Commissioners.

The Exploitation of the Sand Dunes of Cape Cod.

The physical nature of the "Province Lands," which now comprise about thirty-two hundred acres, situated at the extreme end of Cape Cod, is well described in the report of the Trustees of Public Reservations, submitted to our Legislature in 1895, and is as follows: "The highlands of Cape Cod terminate abruptly at High Head in the township of Truro; north and west of this point the remainder of Truro, and all of Provincetown, is a region of sand dunes bounded by beaches, the curves of which enclose a perfect harbor at the very extremity of Cape Cod,"—and, by the way, it is regarded as the safest and best, as well as practically the only harbor on this coast. "There is evidence that the tides and waves have built one beach after another, each further north than the last, and that the so-called Peaked Hill bar is a new beach now in process of formation. The sand dunes of the old beaches, as they were one by one protected by new beaches to the north, gradually became clothed with the surprisingly beautiful vegetation which adorns them to-day, while the hollows between the ridges, each of which was in its day a race run, have gradually been filled, as the race run is now filling. Many of these hollows among the sand hills contain fresh water ponds, the shores of which support a charming growth of tupelo, sweet azalea, clethra, and the like; and in the shelter of the ridges and even upon their crests grow oaks, maples, beeches, and pitch pines. The layer of surface soil upon the hills is nowhere more than three or four inches deep; but the underlying sand is wonderfully retentive of moisture, so that this peculiar terminus of the Cape presents in its uninjured parts a more verdurous landscape than the main body of the outer Cape can show."

About two-thirds of this area has become by the action of the northwest and northeast winds a bare barren track of wildly drifting sand hills, piled in places to a height of ninety feet, sparsely covered in places on the ridges by beach grass (*Amophilla arundinacea*) the remnants of plantings made in the past by the town of Provincetown and by the United States Government, which expended in beech grass planting between 1826 and 1838 the sum of twenty-eight thousand dollars in an endeavor to repair the damage done to the protecting beaches.

In 1852 another five thousand dollars was expended in the same work; while at various other times even larger sums were spent in the construction of "jetties" and other structures designed to stop the drifting of the sand. Much legislation has been enacted and re-enacted at various times designed to accomplish the same result, but without a marked degree of success.

Now when we look for the cause of all this trouble we find that "Be it enacted" is entirely responsible. In 1692 the Province of Massachusetts Bay acquired all the possessions of Plymouth Colony, and these lands at the Cape came to be called province lands.

In 1714 it was enacted "that henceforth all the province lands on the said Cape be a precinct or district," and in 1827 the following act was passed, "that all the lands on said Cape—being province lands—be and are hereby constituted a township by the name of Provincetown, and that the inhabitants thereof be invested with the powers, privileges, and immunities that any of the inhabitants of any of the towns within the province by law are or ought to be invested with; saving always the right of this province to said lands, which is to be in no wise prejudiced, and provided that no person be hindered or obstructed in building such wharves, stages, workhouses, and flakes, and other things as shall be necessary for salting, keeping, and packing their fish, *or in cutting down and taking such trees and other materials growing on said province lands as shall be needful*," etc.

Immediately following that act the outer portions of these lands were stripped of the growth of trees and shrubs, the sods cut and carted away, thus giving the wind its opportunity. The mobile sand began to drift, and has been at it ever since. It has gradually formed this area into three irregular ridges or dunes, ex-

tending from the outer shore, or ocean side, through the entire length of these lands, and indeed beyond the State's possessions, including a much larger area belonging to individuals. These ridges are being slowly, steadily, but surely moved inland toward the town and harbor, in a general course at the rate of from ten to fifteen feet per year.

A study of this area in the light of past experiences in attempting to quiet the drifting sand by the use of beach grass alone, convinced me that in order to accomplish the desired result a stronger growth of woody plants must be established, and experimental plantings were immediately begun. The Board of Harbor and Land Commissioners, who are in charge of these lands, appointed a competent man to act as superintendent, who devotes his whole time to the work.

Planting operations have been systematically and persistently followed for the past three years. A nursery has been established on the ground for the propagation of such varieties as we find necessary for the work, although we rely in a great measure upon direct seeding.

Beginning on the windward crests of the dunes the area is first planted with clumps of beach grass dug from other portions of the land where, protected from the wind's action, it grows in abundance. Among this grass, which we find with attention will grow easily and hold the sand for a sufficient time, we plant myrica cerifera, genista scoparia, tamarix gallica, rosa lucida, ligustrum vulgare, etc., as well as seed of Pinus maritima, P. rigida, P. sylvestris, P. Austriaca, and several varieties of native oaks and other deciduous trees. Outside of this, considerable areas are being planted with silver poplar and other large growing species to form windbreaks.

The work has now so far advanced as to show for itself that it has passed the experimental stage; the young plants and seedlings have passed successfully through two winters, and made a growth quite unlooked for. We now have every reason to believe that within the next few years, provided our legislators continue to appropriate the necessary amount of money, we can show by the growth here that we not only have redeemed this three thousand or more acres "of the grandest and fairest scenery in all our broad land," and thereby removed all danger to a most valuable harbor, but I believe will have given to our people a practical lesson in forestry that will result in great good to the cause in which we are all so deeply interested, and will bring about a reclamation of thousands and thousands of acres of now practically valueless land on Cape Cod.

In addition to the planting operations a substantial road has been built from the town extending well into the Province Lands, which has been extensively used by the many hundreds of people who annually visit this interesting place.

Besides the growths mentioned we are experimenting to some extent with other species, both foreign and native, and should any of your readers desire to experiment with other kinds we shall be glad to receive either plants or seed, and will plant and faithfully care for them, and report results without cost.

LEONARD W. ROSS.

Boston, Aug. 16, 1897.

Minor Forest Products.

AMERICAN NAVAL STORES.

[Abridged translation by the *Indian Forester* of an article by Schleicher in the *Allgemeine Forst und Jagd-Zeitung*.]

PART II.

In the United States, at the time of the colonization, a considerable quantity of resin was collected from the pitch pine (*Pinus rigida*) of the North Atlantic States, but this species is now so nearly exterminated that the industry has practically died out and the manufacture is entirely confined to the South, where three species are found which yield turpentine in large quantities:

(1) Long-leaf pine, *Pinus palustris;*
(2) Loblolly pine, *Pinus Taeda;*
(3) Cuban pine, *Pinus Cubensis.*

The two last give a fluid resin rich in volatile oil, which on distillation leaves behind only a small quantity of hard colophony. The resin of these two trees flows so readily that the yield only lasts one season. They are, therefore, considered unworkable, except when they occur mixed with *Pinus palustris*. It is, however, possible, and even probable, that with careful management they may be made more productive and that the stretches of forest of *Pinus Taeda* in Arkansas, Louisiana and Texas, as also

the forests of *Cubensis* in Florida, may yet become valuable sources of resin.

At present *Pinus palustris* supplies the principal demand, not only of the United States, but also of the whole world, as the production of France and Russia (which are the only other countries that need be considered) taken together only amounts to one-tenth of the total out-put.

The earliest collection of resin from *Pinus palustris* took place in North Carolina, where, together with the manufacture of pitch and tar, it was a source of income to the first settlers and in later colonial times became a highly paying industry, supplying an important export trade. During the three years, 1768 to 1770, the export to the mother country amounted to 88,111 barrels, 30 gallons crude turpentine, 20,646 barrels pitch, and 88,366 barrels tar, worth altogether 215,000 dollars. This has gone on increasing up to the present, the value of the exports of resin and turpentine in 1893 being 8,682,000 dollars.

The method of tapping for resin varies with the country and species of tree. Corresponding with the position of the resin in the tree, the following three methods may be distinguished:

(1) A blaze is made on the tree, which is enlarged every year, and the resin is either collected in a hollow at the foot of the blaze (or, as in France, in a special vessel), or else allowed to get hard on the blaze and then scraped off, as in the case of the spruce.

(2) Holes are bored into the part of the tree where the resin is formed or stored up, as in the heartwood in the case of larch.

(3) The resin ducts in the bark are opened, as is done in the case of the balsam fir.

Apart from the species of tree, the production of turpentine depends on—

(1) The dimensions of the tree, the production, *cæteris paribus*, increasing directly with the size.

(2) The situation; everything that is favorable to the growth of the tree, such as an open or sunny locality with an easterly or southerly aspect, increases the production of resin.

(3) The weather, particularly during the time of collection; prolonged heat and continuous rain are equally unfavorable, and a cold spring always prognosticates a poor harvest. The flows of resin increase from spring to autumn.

(4) The length of time the tapping lasts; during the first two or three years the yield is less than in those following. The Austrian pine appears to yield its maximum between the fourth and fifth year, or, in the case of very large trees, between the seventh and ninth year. This species in favorable localities can stand continuous tapping for 30 years, but it ceases to pay after six or eight years in the case of small stems, or ten to twelve years in the case of larger trees.

(5) The skill and care with which the tapping is done. As regards the age at which the tapping should be carried out, it has been shown that the best time is when the tree has reached its greatest height, and has, so to speak, arrived at maturity. The investigations of Fernow show that the maximum production of the long-leaf pine lies between the ages of 70 and 80 years. He is of the opinion that the maximum is generally reached when the formula $\frac{d}{n}$ (diameter divided by the age in years) has its greatest value. With a view to the subsequent utilization of the trees as timber, he fixes the minimum diameter at which tapping should commence at 14 inches, but the best size for both turpentine and timber production would be a diameter of from 18 to 20 inches.

In France, 14 inches, corresponding to an age of 30 years, is considered a reasonable minimum. In Austria, tapping begins when the trees are from 8 to 10 inches in diameter, or, in the case of the spruce, 12 inches. In the United States, on the other hand, every tree which appears likely to yield a profit to the extractor is ruthlessly tapped, under which course of ill-treatment the industry is digging its own grave.

Fernow draws attention to the relationship that exists between the formation of resin and the state of the foliage, and points out that a tree can only yield resin in abundance so long as it is in perfect health, especially in the case of species like the long-leaf pine, in which the resin is produced in the sapwood. These matters ought to be taken into consideration in regulating the width and number of the blazes, while the facts that the resin ducts run vertically and that a long lead from the point where the resin exudes causes evaporation and consequent loss, indicate the desirability of making the blazes as short as possible.

Under the rational French system, the blazes are made 4 to 5 inches broad, with a depth of barely half an inch, and at the commencement are not more than four inches long. Under this treatment the tree can continue to yield resin throughout the term of its natural life. In Austria the trees are blazed over two-thirds of their circumference, and the length is at first only two inches. In the United States, "boxes" or reservoirs to catch the resin, are cut 10 to 12 inches deep in the tree, and the blazes are 12 to 14 inches wide, their number varying according to the size of the stem, no regard whatever being paid to the future well-being of the tree.

The American system, therefore, in no way fulfils the conditions of economical tapping, the Austrian system does so to a certain extent, but the French plan is the only rational one.

Frequent emptying of the resin reservoirs diminishes the loss of oil by evaporation. Scraping should be done only with the greatest care, and as there is practically no evaporation from the dried resin, it need not be often repeated.

The following is an exact description of the American method as described by Dr. Charles Mohr, Agent to the Division of Forestry.

In establishing a turpentine "orchard" and still, two considerations must be taken into ac-

count: first, suitable conditions with regard to the export of the manufactured article, and, secondly, a sufficient supply of water for condensing. The copper stills commonly in use have a capacity of 800 gallons, which corresponds to a charge of from 600 to 750 gallons of crude resin. To keep a still of this size in continuous work during the season, filling it twice a day, not less than 4,000 acres of well stocked pine forest are required. A block of this size is divided into 20 compartments, each with about 10,000 "boxes," or resin reservoirs cut into the tree. A compartment is termed a "crop," and is the unit alloted to each workman. The work begins in the early winter with the cutting out of the boxes. Until a few years ago no trees were tapped under 12 inches in diameter, but recently the workings have included trees as small as eight inches. Two to four boxes are made in each tree according to size, so that 10,000 boxes require 4,000 to 5,000 trees, or about 200 acres of forest.

The boxes are cut 8 to 12 inches above the base of the tree, 6 to 5 inches high by 14 inches broad, slanting inwards at an angle of 35 degrees, and penetrating .7 inches into the tree. The reservoir is capable of holding about 3 pints.

To protect the boxes from danger of fire, the ground is cleared within a radius of three feet of the tree, and all inflammable material is heaped together and burnt. The burning of these heaps destroys the surrounding young growth, and, unless care is taken, spreads to the neighboring forest for miles around.

The flow of turpentine begins with the first days of spring, and at the same time the "chipping" is begun, by which a blaze is made, 2 inches broad, 1 inch deep and 10 inches high immediately above the box. The surface of this blaze is then chipped or hacked, for which purpose a special tool, called the "hacker," is used. This is a strong knife with a curved edge fastened to an iron handle, at the other end of which is an iron ball of about 4 lb. weight serving to give impetis to the blow.

When the flow begins to diminish, new cuts are made with the backer, and this is repeated from March to October, often lasting over 32 weeks. The length of the blaze increases every month from 1½ to 2 inches.

The accumulated resin is scooped out of the boxes with a ladle, and emptied into a cask for transport to the factory. During the first season the boxes are emptied seven times on an average, the 10,000 boxes yielding at each emptying about 1,200 gallons of "soft gum." The flow is most abundant during the hottest time of the year, in July and August, and gradually ceases with the setting in of the cooler weather, until in October or November it completely stops. When the resin begins to harden it is scraped out of the box and blaze with a sharp scraper with a wooden handle. The result is scrape or "hard gum," which is of a dirty white color, more or less mixed with foreign bodies, and only contains half as much oil as the soft gum. The first season gives a yield of about 8,400 gallons of liquid resin and about 2,100 gallons of hard resin, which produce 2,000 to 2,100 gallons of spirits of turpentine and 260 barrels (of 30 gallons) of colophony of superior quality.

In the second year the boxes are emptied five or six times, yielding 6,750 gallons of soft gum and 3,600 gallons of hard resin, from which about only 1,900 gallons of spirits and 200 barrels of colophony are obtained. The resin becomes yearly darker in color and less fluid. In the third and fourth years the boxes are only emptied three times, the yield in the third year being 3,600 gallons of hard resin, from which is obtained 1,100 gallons of spirits and 100 barrels or more or less dark colophony. In the fourth year the yield of soft resin is somewhat less, and that of hard resin 3,000 gallons producing 790 gallons of spirits and 100 barrels of colophony of the lowest quality. Tapping ceases as a rule after the fourth year.

It appears that the business of distilling requires great care and skill in order to avoid overheating and loss of spirits, and to ensure that the product is of the best quality.

As soon as the still is heated somewhat above the melting point of the resin, a gentle stream of tepid water is allowed to flow into it from the condenser, and this is continued till the end of the process, which is indicated by a peculiar noise arising in the boiling mass, and by the diminished yield of oil from the still. The temperature and amount of water admitted have to be regulated very carefully.

As soon as the distillation is completed the fire is put out and the contents of the still drawn off through a stop-cock at its base. The melted colophony first passes through a wire sieve, and is then filtered through a coarse cotton cloth into a large trough, whence it is poured into casks holding 280 lbs. each.

A turpentine distillery, working on a basis of 50 "crops," produces during the whole four years 120,000 gallons of spirits of turpentine, and nearly 12,000 barrels of colophony, or 2,800,000 lbs., worth approximately £12,000. The market price of the spirits of turpentine varies during the same season from a shilling and three half-pence to one-and-sevenpence fa thing per gallon.

The average yield of a tree during the period of four years' tapping is from ½ to 1·5 gallons of spirits, and 3·75 gallons or 30 lbs. of colophony of the better quality, worth altogether three shillings. The cost of extraction comes to two shillings and twopence-halfpenny, so that the net profit per tree per year is a little less than two-pence-halfpenny, or from four to five shillings per acre.

It is calculated from the quantity of resin and spirit annually placed on the market that 2,250,000 acres of forest are in process of being tapped, and that 800,000 acres of virgin forest are every year brought into request, although at the commencement of the report Fernow estimates the latter at only 500,000 to 600,000 acres.

In the final article of the report Dr. Mohr

discusses the turpentine industry, and draws attention to the improved method of distilling by steam as practiced in New Orleans, which gives 30 per cent. more spirit than distillation over an open fire, without at all affecting the quality of the colophony.

He then describes the method of making turpentine from the wood of the long-leaf pine in an iron retort by means of super heated steam, by which otherwise worthless pieces and sawdust can be utilized. The process is as follows: The wood is cut up into short pieces, and wheeled on iron trucks into a steel retort 20 feet long and 8 feet in diameter, capable of containing three cords or 6,000 lbs. The doors are then hermetically closed and superheated steam introduced, the retort being at the same time heated by means of a moderate fire. Distillation begins after six hours, at a temperature of 150° C.; during the next four hours the temperature is raised to 160° C., until no more liquid comes over. Steam is then shut off, and destructive distillation over an open fire is commenced. During the next 15 hours the temperature is raised to from 160° to 460° C., and the whole process lasts 24 hours. The residue is charcoal of good quality. A cord of wood yields from 5 to 18 gallons of spirits of turpentine and from 53 to 100 gallons of heavy oils and tar, known as creosote, or 60 gallons of strong acids with a specific gravity of 1.02 or 122 gallons of weaker acids. The gas is used for heating the still.

Correspondence.

HOQUIAM, Wash., June 10, 1897.

Editor of The Forester:

Please do me the favor of printing in the next issue of THE FORESTER a list of the principal English, French and German forestry journals. F. L.

We are acquainted with the following periodicals. There are probably others of equal importance:

The Indian Forester, Dehra Dun, India.

Revue des Eaux et Forets, Paris, France, 13 Rue des Saints Peres.

Bulletin de la Societe Centrale Forestiere de Belgique, Brussels, Belgium.

Schweizerische Zeitschrift fur Forstwesen, Bern, Switzerland.

Allgemeine Forst und Jagd-Zeitung, Frankfurt am-Main, Germany.

Centralblatt fur das Gesammte Forstwesen, Vienna, Austria.

Zeitschrift fur Forst und Jagdwesen, Berlin, Germany.

Forstwissenschaftliches Centralblatt, Berlin, Germany.

Forstliche Naturwissenschaftliche Zeitschrift, Munich, Germany.

BOSTON, Mass., Aug. 1st, 1897.

Editor of The Forester:

I am engaged with other men in examining, with a view to purchase, a large tract of spruce timber land. The land is of great variety naturally. Part of it has been cut, part is uncut. Our first business is to estimate the amount of standing spruce timber, but my employers, desiring to derive a permanent yield of lumber from their land, wish it examined also with that in view. Such questions as these they are asking me: What per cent. will the growth of small timber earn if we leave it to grow? How much land must we have to be sure of an unfailing supply for our mill? What practicable measures can we take to make it more productive.

We are dealing with these questions in the field as best we can. Owing to the diversity of opinion on this subject, I hope you will publish thls letter in order to secure suggestions from foresters throughout the country. The questions of taxation are the most pressing ones—those relating to stock standing on the cut lands and its increase by growth. How can I get at approximate figures for large areas and a great variety of land?" A. C.

Publications Recently Received.

Proceedings of the American Forestry Association, Vol. XII, pp. 1–68, July 1, 1897. Contains list of members and officers up to date, articles of incorporation, constitution, account of the fifteenth annual meeting in Washington, February 5, 1897, and a resumé of forestry legislation up to date.

Smithsonian Report for 1895.

Second Annual Report of the Chief Fire Warden of Minnesota for 1896. Contains various communications in reference to forest fires, showing commendable activity in preventing and extinguishing them; short account of forest service in other countries, extracts from bulletin of the Minnesota Agricultural College on "Rate of Increase on the Cut over Timber Lands in Minnesota," and opinions of the Fire Warden Law.

Transactions of the Massachusetts Horticultural Society for 1896.

Bulletin Scientifique de la France et de la Belgique. Champignon Parasite du Hanneton Commun par Alfred Giard.

Beretning our Skadeinsekter oy Plantesygdomme i 1896. Of W. M. Schoyen, Stats.entomolog, Kristiana, Norway.

Prof. C. S. Sargent is in British Columbia.

The American Forestry Association.

SPECIAL AUTUMN MEETING AT NASHVILLE, TENN., SEPTEMBER 22, 1897.

Excursion to Asheville, Biltmore, the Blue Ridge, Lookout Mountain, and the Nashville Centennial Exposition, leaving Washington, D. C., September 16, 1897.

Committee of Arrangements: E. C. McDowell, Chairman, Nashville, Tenn.; George P. Whittlesey, Secretary, Washington, D. C.; George H. Moses, Concord, N. H.; J. D. W. French, Boston, Mass.; Warren Higley, New York City; John Gifford, Princeton, N. J.; John Birkenbine, Philadelphia, Pa; C. A. Schenck, Biltmore, N. C.; John R. Proctor, Frankfort, Ky.

Local Committee at Nashville: E. C. McDowell, Chairman; J. Baird, Secretary; A. E. Baird, G. H. Baskette, R. E. Folk, J. B. Killebrew, G. P. Thruston, R. H. Yancey, J. B. Ransom.

THE MEETING.

WEDNESDAY, SEPTEMBER 22.—The autumn meeting of the American Forestry Association will occur on this date at Nashville, Tenn.

The sessions will be held in the Auditorium at the grounds of the Centennial Exposition, the morning session at 10 o'clock and the afternoon session at 4 o'clock.

PROGRAM.—Call to order by Colonel McDowell. Address of welcome by Governor Taylor. Response by President Appleton. Short address by Mr. E. C. Lewis, Director-General of the Exposition. Papers devoted to Forestry at the South. ("The Forest Flora and Conditions of Middle and East Tennessee," by Mr. George B. Sudworth, Agricultural Department; "Forests of Tennessee," by Colonel J. B. Killebrew, formerly State Commissioner of Agriculture; "Forest Conditions in the South Atlantic States," by Mr. J. A. Holmes, State Geologist of North Carolina. Also papers by Hon Thomas C. McRae, of Arkansas; Mr. A. V. Clubbs, of Pensacola, Fla.; Rev. Robert Nourse, of Falls Church, Va., and others.)

At the afternoon session the papers will relate to Forestry and Streams. Mr. George W. Rafter, of Rochester, N. Y., will discuss "Stream Flow in Relation to Forests;" Mr. H. A. Hazen, of the Weather Bureau, "Forests and Rainfall;" Mr. D. W. Baird, editor of the "Southern Lumberman," "Effect of Destruction of Forests on Water Courses;" Mr. F. H. Newell, of the Geological Survey, "Forests and Irrigation."

Music will be furnished by the band.

If an evening session is held, it is hoped that an address will be delivered bearing upon the recent action of Congress in regard to Forest Reserves.

THE EXCURSION.

THURSDAY, SEPTEMBER 16.—Arrangements have been completed by which members and their friends will leave Washington, D. C., over the Southern Railway at 10.43 p.m. (train 37.)

FRIDAY, SEPTEMBER 17.—Members taking sleeping car to Salisbury only will change cars there at 8.17 a.m., having plenty of time for breakfast before the arrival of the Asheville train (No. 11.) Passengers taking a Pullman car through to Asheville will breakfast at High Point, N. C.

From Salisbury the road runs up across the Blue Ridge. The scenery is among the finest east of the Rockies. The train stops for lunch at Round Knob, one of the most picturesque spots on the line.

Biltmore.—Arrive at 2.15 p.m. Here the party will be met by Dr C. A. Schenck, Chief of the Forestry Department of the famous estate of Mr. George W. Vanderbilt, a Life Member of the Association. Leaving all hand luggage in charge of a baggage agent (trunks can be checked to Asheville) the party will take carriages and drive over a portion of Biltmore. Dr. Schenck has kindly and carefully planned our visit, so that everything will be seen to the best advantage. Especial attention will be given to the extensive forestry system.

The terminus of the drive will be the Battery Park Hotel at Asheville, where the party will find quarters for the night. This handsome house commands charming views of mountain scenery.

Friday evening, short talks will be given in the ball room by Dr. Schenck, and by Mr. M. V. Richards, the Land Agent of the Southern Railway, who has consented to accompany the party.

SATURDAY, SEPTEMBER 18.—Starting at 8 o'clock a second visit will be paid to Biltmore, since the many interesting features of this magnificent estate cannot be seen in a single afternoon. Return to the hotel in time for dinner.

At 2.30 p.m. take the train for the South. The road follows the French Broad River, and the scenery is most beautiful. Supper at Knoxville, Tenn. Arrive at Chattanooga at 11.35 p.m. A half hour's ride takes the party to the top of Lookout Mountain, where accommodations will be found at the attractive Lookout Inn.

SUNDAY, SEPTEMBER 19.—The day will be spent in rambling over the mountain, enjoying the grand views and studying the great military movements which took place there in 1863. During the evening, the party will descend the mountain and take the train which leaves for Nashville at 1 a.m. over the Nashville, Chattanooga and St. Louis Railway.

MONDAY, SEPTEMBER 20.—Arrive at Nashville at 6.45 a.m. The party will be received at the Maxwell House, which is conducted on the European plan. This day, and also Tuesday and Thursday, may be devoted to sight seeing. The Exposition, though small as compared with the World's Fair, is yet of great interest. The city of Nashville and its environs are well worth seeing.

The climate of Nashville for the last ten days of September is most agreeable. Mr. Hazen, of the Weather Bureau, states that during this time the rainy days average 1½, while the average temperature for 16 years has been, maximum 76 and minimum 57.4 degrees.

WEDNESDAY, SEPTEMBER 22.—The meeting of the Association will be held as above set forth.

THURSDAY, September 23.—At 11.20 p.m., the party will start homeward over the Southern Railway. The return trip will be continuous.

SATURDAY, SEPTEMBER 25.—Arrive at Washington at 6.42 a.m., in time for members coming from Philadelphia, New York and Boston to reach home during the day.

THE COST.

The total cost of the nine days' trip, including everything, is estimated at a trifle less than $50.

Through the courtesy of the Southern Railway Co., members of this party can purchase excursion tickets from Washington, D. C., good for ten days from date of sale, for $15.30, with stopover at Asheville and Chattanooga going. This is a special favor, and must not be advertised. Tickets on sale September 16th only.

The Battery Park Hotel has made us a special rate of $3 per day; the Lookout Inn, $3 per day; the Maxwell House, $1 to $2 per day for room only. Room with bath, $2.50; if occupied by two persons $2 each.

Messrs. Chambers, Weaver & Co., Liverymen at Asheville, will furnish carriages to Biltmore for $1.60 per person. This sum covers both trips.

The Pullman Car. Co. make no reductions from their regular rates, which are as follows: Washington to Salisbury, one double berth, $2; Washington to Asheville, $3; Chattanooga to Nashville, $2; Nashville to Washington, two nights and a day, $5.

The fare up Lookout Mountain is 75 cents for the round trip. Cars start from the Central Union Station in Chattanooga.

Admission to the Exposition is 50 cents. Cars run direct from the Maxwell House to the grounds.

A PROMPT REPLY

to this announcement is earnestly requested, in order that your committee may be able to make proper provision for all.

A certificate will be sent for each person named, entitling said person to all the special rates mentioned above. Each member of the party will pay his bills as he goes, using the certificate to obtain the benefit of the reductions.

If 25 names are not enrolled before September 5th, the excursion will be declared off. In that event, members will be obliged to make their own arrangements for getting to the meeting.

PERSONS NOT MEMBERS

of the Association will please remit $2 as the membership fee, when sending in their names for the excursion party.

Address—

GEORGE P. WHITTLESEY,
Atlantic Building,
Washington, D. C.